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Ministry of Education and
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Science & You

LEARN AND INNOVATE

Sixth Primary
6

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Student's Book

First Term

Prepared By

Mr. Mohamed Reda Ali Ibrahim

Dr. Mohamed Ahmed Abu Leila

Dr. Ahmed Reyadh El Sayed Hassan

Science Consultant

Dr. Aziza Rgab Khalifa

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Introduction

Dear pupils:

We are pleased to present this book (**Science and you**) which represents one of the cornerstones of the developed curriculum in science for sixth primary grade. This book achieves the curriculum development process to face the challanges of the twenty first century whose beginning goes in line with a competitive revolution in information and communication technology.

The curriwlum aims to achieve the following trends:

- Enlightening you with the relationship between science and technology in the science field and its impact on development.
- Ensurning the suitable situations that indicate the influence of scientific and technological progress in producing knowledge.
- Focusing on your practice of reasonable and effective behavior towards using technological outputs.
- Ensuring your acquistion of the scientific thinking methodology which enables you to move away from education based on recitation and pouring information to education based on self-learning merged with fun and excitement.
- Focusing on your dependence on exploration to reach information and acquire more experiences, through improving basic thinking skills: observation, analysis, deduction and justification.
- Providing you with opportunities to practice the roles of citizenship through self-learning methods, team work, negotiation, persuation, acceptance of the other opinion and avoidance of fanatism.
- Working on your acquisition of life skills and management applied practical abilities through giving more concern to the practical and applied aspects.
- This book consists of four units. Each unit includes integrated lessons that achieve the desired objectives of each unit.

We ask God Almighty that you gain advantage of this book. We pray Him that this book will be one of the cornerstones to be added to the love and belonging to Egypt.

Preparation Team

Contents

First Term

Unit (4)

(Structure and Function of the living Organisms)

Safety in Science

Scientists know that they must work safely when doing experiments. You need to be careful when doing experiments too. Here are some safety tips to remember.

Safety Tips

- ✔ Read each experiment and activity carefully.
- ✔ Wear safety goggles when needed.
- ✔ Clean up spills right away.
- ✔ Never taste or smell substances unless directed to do so by your teacher.
- ✔ Handle sharp items carefully.
- ✔ Tape sharp edges of materials.
- ✔ Handle thermometers carefully.
- ✔ Use chemicals carefully.
- ✔ Dispose of chemicals properly.
- ✔ Put materials away you finish an experiment.
- ✔ Wash your hands throughly after each experiment.

Force and Motion

Unit Objectives

By the end of this unit, you should be able to:

- Determine the weights of some objects using the spring balance.
- Compare between mass and weight.

Unit introduction

Mass and weight are two terms you often hear in your daily life when selling and buying what is mass and weight?...... And other questions that we will try to answer in this unit.

What can you see in this picture?
Record your observation.
Share in discussion with your classmates and your teacher.
Lesson One
Mass and Weight

UNIT 1

Lesson One (1 -1)

Mass and weight

Objectives

By the end of this lesson, you should be able to:

- Determine the weights of some objects using the spring scale.
- Compare between mass and weight.

Basic concepts

- Mass
- Weight

The confusion between mass and weight is considered one of the most common mistakes in our daily life especially what is related to exchanging goods.

This is because the meanings of the two terms become the same in one way or another among people. Even the accurate scientific explanation does not help people to understand the real difference between mass and weight.

Fig (1-1): *A flour bag*

Discover the concept of mass

Exercise

◉ Look at the following pictures and then answer the questions:

▲10 bananas balance with 1000 grams.

▲ 9 bananas balance with 900 grams.

▲ 2 eggs balance with 120 grams.

▲ The searchlight balances with 120 grams.

Fig (1-2): *A group of objects of different masses.*

- Is the mass of 10 bananas equal to the mass 9 bananas? (Yes / No). Why?
- Does the mass differ according to the amount of bananas? (Yes / No). Why?
- Is mass of the matter in eggs equal to the matter of the searchlight? (Yes / No). Why?

◉ **In this exercise**, we find that: the mass of bananas depends on its amount. This means that mass depends on the amount of matter. We also find that the mass of eggs is equal to the mass of the searchlight. This means they both contain two equal amounts of matter.

★ ***Mass:*** **the amount of matter in an object.**

★ Mass is measured in gram or kilogram. The gram may equal the mass of a paper clip whereas the kilogram is equal to a liter of distilled water.

Fig (1-3): *A paper clip is equal to one gram.*

Fig (1-4): *A liter of distilled water equal to 1000 gram.*

Mass and weight

Mass measurement:

Different types of scales are used to measure the mass such as: The balance scale and one-arm scale.

▲ A balance scale

▲ A sensitive two-arm scale

▲ A one-arm digital scale

▲ A one-arm scale with a pointer

Fig (1–5): *Different types of scales*

Enriching information

There is a relation between mass and motion. The more an object's mass increases, the more difficult it is to change its speed. For example, the locomotive has bigger mass than the car, so the locomotive needs a stronger force to stop than what is needed for the car.

We should point out that the scale's choice should match the amount of matter we need to measure its mass.

For example, the grocer's balance cannot be used to measure the mass of gold and vice versa.

Activity

How do we measure ...

◉ What do you need? A balance scale, standard masses, the object that we need to measure its mass.

◉ **What should you do?**

- Put the balance scale on a stable shelf horizontally to avoid any vibrations.
- Make sure that the balance scale is clean in and out.
- Put the object on one of the arms.
- Put standard masses on the other arm until the two arms balance
- Add up the written numbers on the standard masses. The total is the mass of the object.

Fig (1 - 6): *Two-arm scale with mass known weights*

★ *We conclude that:* The object mass is equal to the total mass of balance masses that are already known.

Does mass differ from one place to another?

After measuring the mass of an object on the Earth's surface then measuring the mass of the same object on the moon's surface, we will notice that mass is not changed, i.e. mass of objects is stable and does not change from a place to another.

▲ The object's mass on the Earth is 5 kg.

▲ The object's mass on moon is 5 kg

Fig (1 - 7): *Object's mass is constant and does not change from one place to another.*

The concept of weight:

Discover the concept of weight

Exercise

◉ Look at the following pictures, and then answer the questions:

Fig (1 - 8): *Children on the Earth surface*

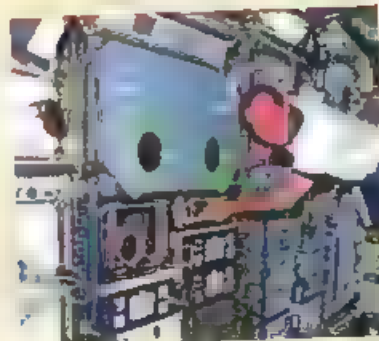



Fig (1 - 9): An *astronaut inside a spacecraft*

- Does the astronaut fall down when he jumps from a high position? (Yes / No).
- If the astronaut carries something and leaves it, will it fall down? (Yes / No).
- Does a person fall down when he jumps up on the Earth's surface? (Yes / No).
- If you carry your pen and leave it while you are on the Earth's surface, will it fall down?
- What makes objects fall downward towards the Earth?

◉ The fact of objects' falling downward the Earth means that there must be a force which pulls these objects down. You can feel this force if you carry an object or if you try lifting an object. This force is called "weight".

★ *Weight:* is the force with which a body is attracted to the Earth. This force is always towards the centre of the Earth.

★ Weight is measured in Newton. Newton is almost equal to the weight of an object whose mass is 100 grams. For example, the gravitational force of a small apple (its mass is 100 grams) is equal to Newton.

Fig (1-10): An apple.

★ Given that the acceleration due to the earth gravity equals 10 m/sec^2.

Measuring weight

A weight of an object can be measured by the spring balance through determining the distance a spring goes down under the object's weight.

Fig (1-11) *The spring scale*

Activity

◎ **What do you need?** A spring scale, an object (can)

◎ **What should you do?**

- Hold the spring scale from its top. Then, hang the object in the bottom hook. If you can not hang the object in the bottom hook, tie it with thread and then tie the thread in the bottom hook.
- Let the object go down slowly. You will notice that the object pulls the spring downwards and the reading of the pointer increases.
- Wait until the object becomes stable and then read the number which refers to how many Newtons the down force is exerting and equal to the object's weight.

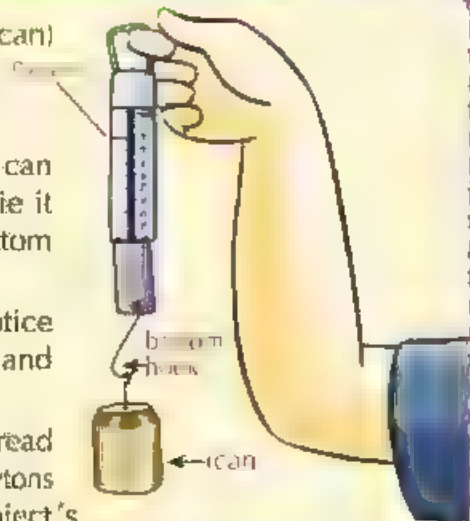



Fig (1-12): *How do you measure the weight?*

Factors that affect weight

The object's weight is affected by three factors:

(1) The object's mass.

(2) The planet (place) where the object exists.

(3) Distance from the center of the planet.

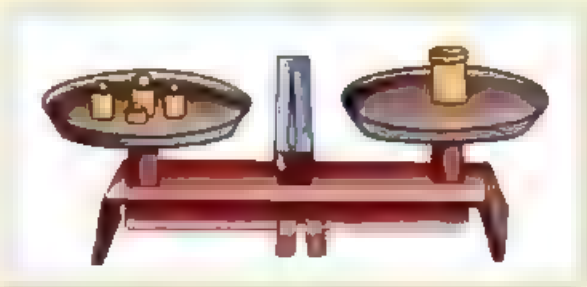
We will discuss these factors in details:

1 The object's mass

The object's mass affects its weight. You can make sure of this by doing the following activity:

Mass and weight

Activity

- What do you need? a normal scale, a spring scale, some objects different in mass.

- **What should you do?**
  - Assign the first object's mass using the normal scale.
  - Assign the first object's weight using the spring scale.
  - Repeat the previous steps with the rest of the objects.
  - Write down the obtained results in a table.

- Suppose you got the following results from the previous activiy

The object's mass (kg)	1	2	3	4	5
The object's weight (Newton)	10	20	30	40	50

What is the relation between mass and weight?

We can conclude that the weight of an object on the surface of the Earth increases according to the increase in the object's mass.

Weight (Newton)= mass (kg) x 10

❷ The planet where the object exists

Weight differs according to the planet or (the moon) where the object exists. The more the planet's mass, the more the gravitational force and the more the object's weight. For example, on measuring an object's weight on the surface of the Earth, and then measuring the same object on the surface of the moon, we notice that weight changes.

Fig (1 - 13): *The object's weight on the Earth's surface is equal to 6 Newton.*

Fig (1 - 14): *The object's weight on the moon's surface is equal to 1 Newton.*

⦿ **The object's weight on the moon is equal to one sixths ($\frac{1}{6}$) of its weight on Earth.**

❸ Distance from the center of the planet:

The object's weight is affected by the distance being away from the center of the planet. The Earth gravitational force decreases as the body moves away from the Earth. We don't usually notice this difference in weight because it is very little in such a case.

Fig (1 - 15): *A balloon*

Comparison between mass and weight:

Point of comparison	Mass	Weight
Definition	The amount of matter in an object	The force with which a body is attracted to the Earth
Unit of measurement	Kilogram or gram	Newton
Device of measurement	A balance scale	A spring scale
direction	Has no direction	It is towards the center of the Earth
Effect of different places	Constant (does not change with the change in place	Changes from a planet to another

Exercises

1 Complete the following sentences:

a The measuring unit of mass is .... or .... whereas the measuring unit of weight is ....

b Mass is measured by .... whereas weight is measured by ....

c Mass is a constant and is not affected by ....

d The object's weight depends on .... , ... and ....

2 Write the scientific term:

a The amount of matter in an object.

b The force with which a body is attracted to the Earth.

c The measurement unit of mass which is almost equal to a mass one liter of distilled water.

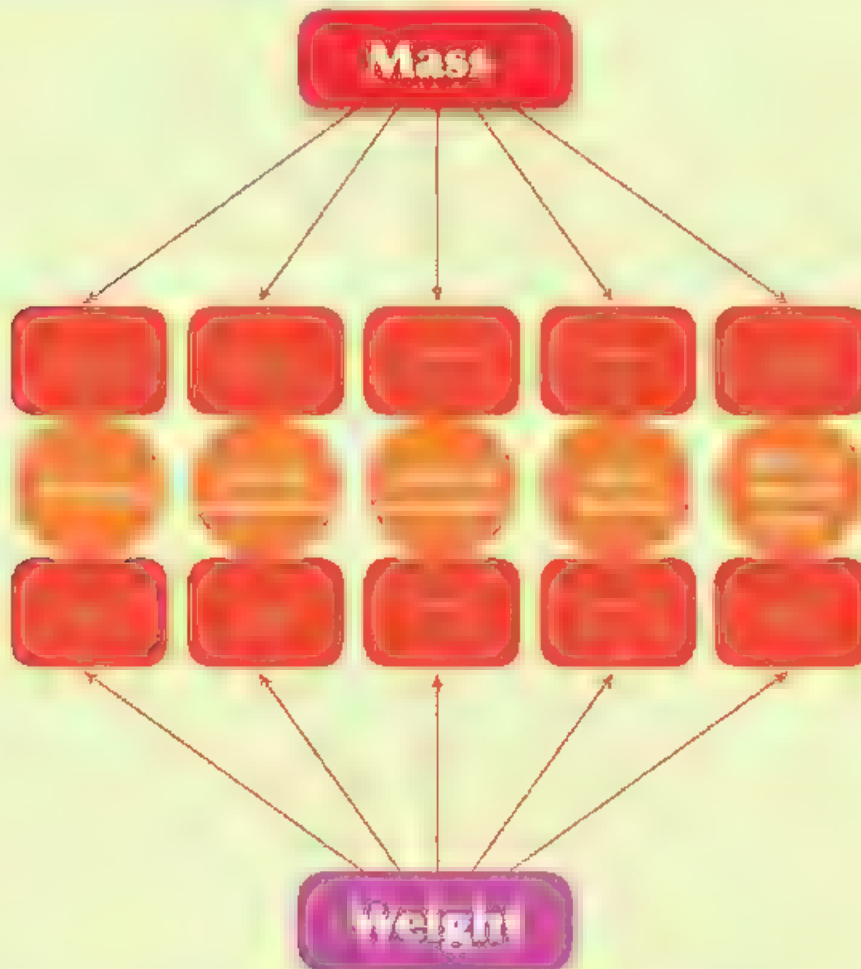
d The measurement unit of weight which is almost equal to a mass 100 grams.

3 An object whose mass on Earth is equal to 6 kg. Calculate its weight on both surfaces of the Earth and the moon.

4 The following pictures illustrate the steps of calculating a liquid mass using the digital scale. Look at the pictures and then calculate the mass and weight of this liquid.

▲ Scale reading = 119.76 gm

▲ Scale reading = 186.73 gm

5 Complete the following diagram.

6 **Match from column (A) with the suitable term in column (B):**

(A)
The force with which a body is attracted to the earth
The measuring unit of mass
The measuring unit of weight
The amount of matter in an object

(B)
Newton
Mass
Kg
Weight
Spring scale

Unit (1) Test

1 Choose the right answer:

a. The device of measuring weight is ....

1. one-arm scale. 2. two-arm scale. 3. digital scale. 4. spring scale

b. An object whose weight is 20 Newton on earth, its mass is equal to ....

1. 10 kg. 2. 2 kg. 3. 200 kg. 4. 20 kg.

2 Complete the following sentences:

a. Mass is measured by .... whereas weight is measured by ....

b. Mass is the amount of matter that body contains. It does not change according to ....

c. An object's weight depends on ...., ... and ....

3 Fill in the following table:

Point of Comparison	Mass	Weight
Definition		
Unit of measurement		
Device of measurement		
Direction		
Effect of different places		

4 If an object's mass = 30 kg on Earth, calculate:

a. Its mass on the moon.

b. Its weight on the Earth.

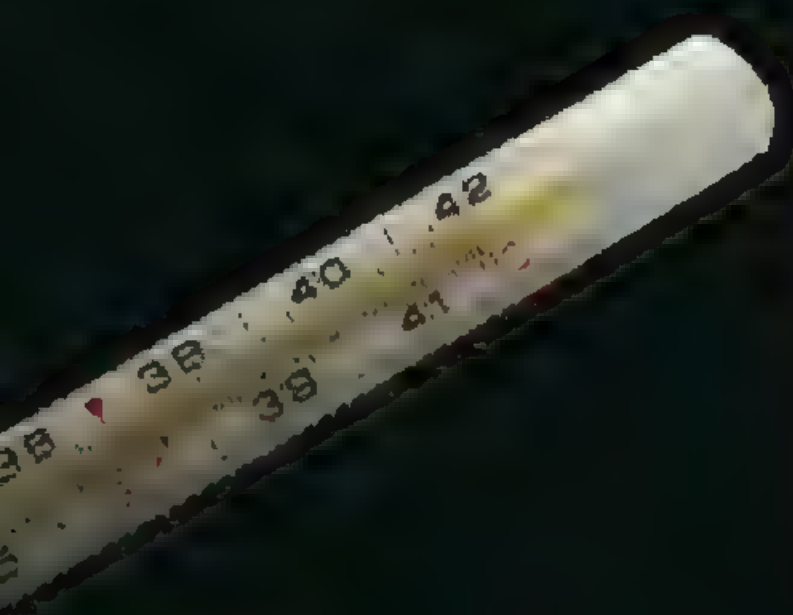
c. Its weight on the moon.

2

Thermal Energy

By the end of this unit, you should be able to:

- Determine some materials that are good conductors of heat or bad conductors of heat.
- Do experiments to show the various metals to conduct heat.
- Determine the usages of the good and bad conductors of heat.
- Compare between the medical thermometer and Celsius thermometer in usage and structure.

Heat is used in our daily life in different aspects. Heat flows from an object to another when they are different in temperature. Some materials are good conductors of heat while others are bad conductors of heat. So, we will see some examples of each type and their different usages as well as different types of thermometers used in measuring temperature.

What can you see in this picture?
Record your observation
Share in discussion with your classmates and your teacher.

Lesson One

Heat conduction

Lesson Two

Measuring temperature

Lesson One (2 - 1)

Heat conduction

Objectives

By the end of this lesson, you should be able to:

- Do simple experiments to determine some materials that are good conductors of heat or bad conductors of heat
- Do experiments to show the different degrees of various metals to conduct heat.
- Determine the usage of the good and bad conductors of heat.

Basic concepts

- Heat
- Temperature
- Good conductors of heat
- Bad conductors of heat

What do you know about heat?

Heat is one of the most important types of energies used in our life. We use it at home in various areas such as warming the house, cooking, heating water and drying washed clothes.

In industry, heat has countless usages. It is used in making and processing food, glass, paper, textiles, ... etc.

Different uses of heat

Heat

It is a form of energy that transfers from the higher temperature object to the lower temperature object.

Temperature

It is the degree of hotness or coldness of a body. Special devices are used to measure temperature. These devices are called **thermometers.**

Activity

Find out the good and bad conductors of heat

- **What do you need?** A glass container, a metal spoon, plastic ruler, wooden pencil, molten wax, hot water, clay, three buttons.

Fig (2 - 1) *Different materials differ in conducting heat.*

- **What will you do?**
  - Stick buttons on the ruler, spoon and pencil using the molten wax.
  - Fix the ruler, spoon and pencil to the edge of the container and stick them using clay.
  - Pour the hot water in the container but not to its edge.
- **What do you notice?** ....
- **What do you conclude?** ....

★ *We can conclude that:*

- The different materials (such as plastic, wood and aluminium) differ in conducting heat.

Heat conduction

Activity

What do you need? burner , beaker contains water, and 4 rods of different materials.

What should you do ?

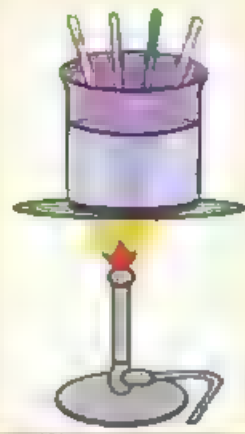
- Prepare 4 rods nearly equal in length and thickness of Aluminum, wood, iron and plastic.
- Put the beaker containing water on the flame and heat water then put the 4 rods inside hot water
- Touch the Aluminum rod from its end.
- Can you feel it hot?
- Repeat the previous steps with the other rods one by one.

What can you conclude? ....
....

Fig (2-2) *The difference in materials leads to the difference in conducting heat.*

★ *We can conclude that:* materials differ in conducting heat and are classified into two types:

- *Good conductors of heat:* they are the materials that conduct heat and let heat flow through such as copper, aluminium, iron and mercury.
- *Bad conductors of heat:* they are known as insulators that do not let heat flow through such as wood, glass, plastic, paper, and air.

Life applications

Air is a bad conductor of heat. That's why it is used in making insulating glass windows.

The window is made by bonding two sheets of glass and maintaining a space between them filled with air to ensure preventing leakage of heat.

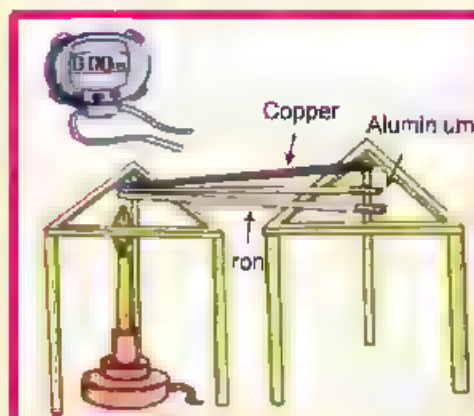
Fig (2-3) *Double glazed window*

Activity

Metals differ in conducting heat

What do you need? Two metal racks, three metal rods with the same length and thickness of copper, aluminium and iron, paraffin wax, office pins, flame, stop watch.

What should you do?

- Lit the paraffin wax and put some drops of molten wax on the tip of each metal rack.
- Stick an office pin on each tip of each metal rod before the wax gets hard.
- Put the three metal rods on the two metal racks as shown in the figure.
- Put the tips of the three metal rods that do not contain paraffin wax above the flame.
- Calculate the required time to drop the office pins from each rod.
- Write down your notes in the opposite table.

The difference in conducting heat of the metals

Metal	Time (second)
Aluminium	
Copper	
Iron	

What do you notice?

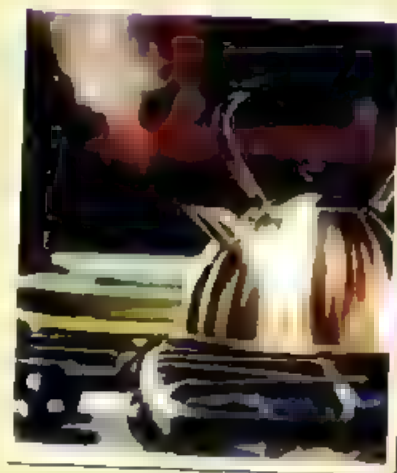
What do you conclude?

★ *We can conclude that:*

- **Different metals differ in conducting heat. We find out that copper conducts heat faster than aluminium and iron do.**

As a result of heat flow through metals, metals expand and get bigger. So, we find spaces between railways, otherwise they expand and twist; an act and that causes train accidents.

Usages of good and bad conductors of heat:

1. Aluminium and stainless steel are used to make cooking pots and kettles in houses and factories.

2. Plastic and wood are used to make handles of cooking pots, kettles and utensils. Moreover, plastic is used to make the iron handle.

3. Heavy blankets and wool clothes are bad conductors. Therefore, they are used in winter to keep the body warm.

Exercises

1 Complete the following sentences:

a. All metals are .... conductors of heat.

b. .... conducts heat faster than aluminium.

c. Some examples of good conductors of heat are .... and ....

d. Some usages of good conductors of heat are .... and ....

e. Some examples of bad conductors of heat are .... and ....

f. Some usages of bad conductors of heat are .... and ....

2 Put (✔) in front of the right statements and (✘) in front of the false statements and correct the false ones:

a. All materials are good conductors of heat. (   )

b. Wood is a good conductor of heat. (   )

c. Cooking pots are made of plastic. (   )

d. Handles of cooking pots are made of copper. (   )

e. Aluminium is a bad conductor of heat. (   )

3 Provide the scientific term for each sentence:

a. Materials that let heat flow through.

b. Materials that do not let heat flow through.

4 Compare between the good and bad conductors of heat.

Lesson Two (2 - 2)

Measuring temperature

Objectives

By the end of this lesson, you should be able to:

- Compare between the medical and celsius thermometers.
- Appreciate the importance of thermometers in our daily life.

Basic concepts

- Thermometer
- Medical thermometer
- Celsius thermometer

Measuring temperature is one of the important things in our daily life. It helps us know the weather temperature which affects our life skills. We know our bodies' temperature to check our health condition. Also, it is very important because some processed food industries recquire a certain temperature. But can we find out if an object is hot or cold by touching it only, or do we need a device to know the temperature accurately?

Heat is used in preparing food

Thermometer

It is a device used to measure temperature.

Fig (2-4). Medical Thermometer

How the thermometer works

To identify how the thermometer works, cooperate with your classmates in doing the following activity:

Activity

Make a thermometer on your own

◉ **What do you need?** Water, ethyl alcohol, plastic bottle, red co ur, straw, clay, a beaker with hot water, a beaker w th ced water.coloring crayon (black, blue and red)

◉ **What should you do?**

- Fill the bottle with similar two quantities of water and ethyl alcohol.
- Add some drops of the red color and stir.
- Put the straw in the bottle where it does not touch the bottom of the bottle.
- Use the clay to fix the straw and close the mouth of the bottle.
- Cut two slits in the hard paper then fix the straw through the two slits . Mark the liquid level using a coloring crayon.
- Put the bottle in a beaker with hot water ; and notice what will happen to the liquid inside the straw.
  Mark the liquid level using a new coloring crayon.
- Put the bottle in a beaker with iced water and notice what will happen to the liquid inside the straw, Mark the liquid level using a new coloring crayon.

Thermometer model

◉ **What do you notice?**

◉ **What do you conclude?**

★ *We can conclude that:*

- The main idea to make a thermometer is changing the volume of the liquid according to the temperature. The liquid expands by heating and contracts by cooling.

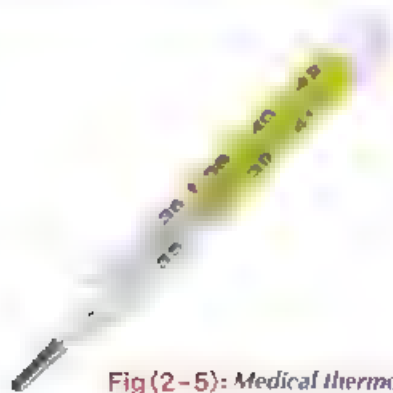



Fig (2-5): *Medical thermometer*

Types of thermometers

There are many kinds of thermometers:

- Medical thermometer
- Celsius thermometer

1 Medical thermometer

Structure of the medical thermometer:

- The medical thermometer consists of:
  - A transparent glass tube which includes a capillary closed from one of its ends.
  - The other end from the capillary tube is connected to a bulb filled with mercury.
  - There is a constriction above the bulb which prevents mercury from going back to the bulb quickly in order to read the measurement easily.
  - The thermometer scale starts from 35°C to 42°C and every degree is divided into ten parts.

Technology applications

There are some modern digital thermometers which display body temperature digitaly and are used to measure body temperature espicialy for children

Fig (2-6): *Structure of medical thermometer*

Enriching information

Did you know that the temperature of a healthy human is 37°C and it may go up during sickness.

- Sterilize the medical thermometer using ethyl alcohol.
- Dry the thermometer very well using a paper tissue.
- Shake the thermometer well until mercury goes back to the bulb.
- Put the thermometer under the tongue for a minute.
- Get the thermometer out from the mouth and record the reading on it.
- Sterilize the thermometer using ethyl alcohol and put it in its box.

Medical thermometer is used in measuring human temperature

** We can conclude that:*

- The medical thermometer is used to measure the temperature of the human body and through the identification number of thermometer which depends on the level of mercury surface and which indicates the temperature of the human body.

Be careful

Do not seize the thermometer firmly with your teeth in order not to be broken because mercury is toxic.

Fig (2-7): *The Celsius thermometer measures the water temperature.*

Celsius thermometer

Parts of Celsius thermometer

- It consists of:
  - A transparent glass tube with a capillary tube closed from one of its ends.
  - The other end of the capillary tube is connected to a bulb filled with mercury, but there is no constriction above the bulb.
  - The thermometer scale starts from zero Celsius until 100 degrees Celsius.

Fig (2-8): *Celsius thermometer*

The Swedish scientist "Andres Celsius" created the Celsius scale in 1742. He considered the zero as the melting point of ice and 100° is the boiling point of water.
He divided the distance into 100 parts, each part is equal to one degree.

Why is mercury preferred in making a thermometer?

1. It is a liquid metal that can be seen easily through the thermometer glass.
2. Mercury is a good conductor of heat.
3. Mercury is a regular expanding material which gives an accurate estimation.
4. Mercury does not stick to the walls of the capillary tube.
5. Mercury remains liquid between two degrees temperature -39°C and 357 °C and this gives a wide range of temperature measurement.

Activity

◉ **What do you need?** A Celsius thermometer, a glass of hot tea, a bottle of cold soft drink, a beaker of warm water

◉ **What should you do?**

- Put the thermometer in the hot tea. Wait until mercury rises up and stops and record the temperature.
- Repeat the previous step but with the cold soft drink and the warm water and record the temperature of each.

The measuring temperature of liquid is used by Celsius thermometer

The liquid that we need to measure its temperature	Temperature
Hot tea	
Cold soft drink	
Warm water	

Be careful

While recording the temperature, the thermometer must be vertical. The direction of sight must be perpendicular to the thermometer.

◉ **What do you notice?**

◉ **What do you conclude?**

★ *We can conclude that:*

- **The Celsius thermometer is used in measuring the temperature of liquids.**

Celsius thermometer is known by this name due to the dividing of distance between ice melting point and water boiling point into 100 divisions.

Exercise

The Celsius and the medical thermometers

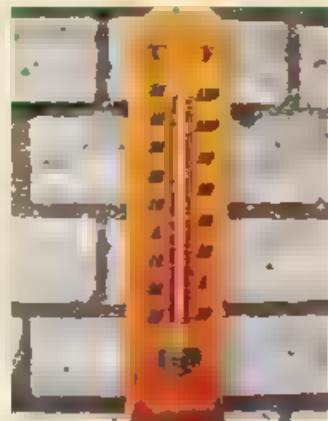
Compare between:

- Celsuis thermometer and medical thermometer:

Points of Comparison	Celsius thermometer	Medical thermometer
Structure		
Range of scale		
Construction		
Used liquid		
Usage		

Exciting Memories

Some thermometers contain two scales, one represents Celsius scale (°C) and the other represents Fahrenheit scale (°F).

0°C = 32°F and 100°C = 212°F

Exercises

1 Complete the following sentences:

a The scale of the medical thermometer starts from .... and ends at ....

b There is a constriction in the .... thermometer.

c The kinds of thermometers are .... and ....

d The Celsius thermometer is used in .... whereas the medical thermometer is used in ....

e The thermometer is ....

f The water freezes at .... and boils at ....

2 Put (✔) in front of the right statements, and (✘) in front of the false statements and correct the false ones:

a The Celsius thermometer is used for measuring the temperature of the human being. ( )

b The scale of the medical thermometer starts from zero until 100 Celsius degree. ( )

c The medical thermometer is used for measuring the temperature of liquids. ( )

d There is a constriction above the bulb in the Celsius thermometer. ( )

e The used liquid in the medical thermometer is water. ( )

3 Write the scientific term for each of the following statements:

a A device used to measure the temperature of liquids.

b A device used to measure the temperature of the human being.

c The liquid used in making thermometers.

4 Compare between the medical and the Celsius thermometer in structure and usage.

5 Write a paragraph on your own on each of the following concepts:

Unit (2) Test

1 Complete the following sentences:

a We measure temperature by using

b is used in measuring temperatures of different liquids whereas is used in measuring the temperature of the human body.

c , and are good conductors of heat

d , and are bad conductors of heat

2 Write the scientific term for each of the following statements:

a A device used to measure temperature.

b The materials that allow the flow of heat inside.

c The materials that do not allow the flow of heat inside.

3 Write the most important uses of the good and bad conductors of heat.

4 Fill in the spaces of following tables:

Points of comparison	Medical thermometer	Celsius thermometer
Usage		
Structure		
Used liquid		
scale		

Points of comparison	Good conductors of heat	Bad conductors of heat
Definition		
Usage		
Examples		

5 Put (✓) in front of the correct statements and (✖) in front of the false one and correct the false ones:

a. Medical thermometer is used in measuring the temperatures of different liquids ( )

b. The scale of the Celsius thermometer starts from 35° to 42°. ( )

c. Aluminum is a bad conductor of haet. ( )

d. Wood is a good conductor of heat. ( )

6 Write an explenation for each of the following:

a. Mercury is used in making thermometers.

b. The handles of cooking utensils are made of wood or plastics.

c. Cooking utensils are made of stainless steel or aluminium.

d. There is a constriction in the medical thermometer.

unit

3

unit

The Atmosphere

By the end of this unit, you should be able to:

- Mention the gases composing the air and their proportions.
- Identify the properties of oxygen.
- Determine the importance and uses of oxygen.
- Do experiments illustrating the properties of carbon dioxide.
- Determine the importance and the uses of carbon dioxide.
- Identify the properties of nitrogen.
- Determine the importance and uses of nitrogen.

Unit Introduction

The Earth's atmosphere consists of a mixture of gasses surrounding it. Nitrogen represents a proportion of 78% of the volume of these gases. Oxygen repesents, 21% of the volume of the this atmosphere. As for the rest of the atmosphere, it consists almost of water vapor, carbon dioxide and other gass such as argon, neon, helium, and othere. In the study of this unit, you will identify the properties, uses and importance of the gases that compose most of the air's components. They are oxygen, carbon dioxide and bitrogen as well as the importance of each one in nature

What can you see in this picture?
Record your observation.
Share in discussion with your classmates and your teacher.

Lesson One

Oxygen

Lesson Two

Carbon dioxide

Lesson Three

Nitrogen

Lesson One (3 - 1)

Oxygen

Unit 3

Objectives

By the end of this lesson, you should be able to:

- Mention the gases composing the air and their proportions.
- Identify the properties of oxygen.
- Determine the importance and uses of oxygen.

Basic concepts

- The atmosphere
- Oxygen

What are the sources of oxygen in the air?

Green plants are the main source of oxygen in the air. Oxygen is produced during the photosynthesis process in order to compensate the consumption of oxygen in the respiration and combustion processes. So, the Earth's vegetation should be maintained.

Plants are the main source of oxygen

The atmosphere is composed of a mixture of gases surrounding the Earth. They are attracted to the Earth by gravity.

Learn about these gases and their proportions as in figure (3 - 2):

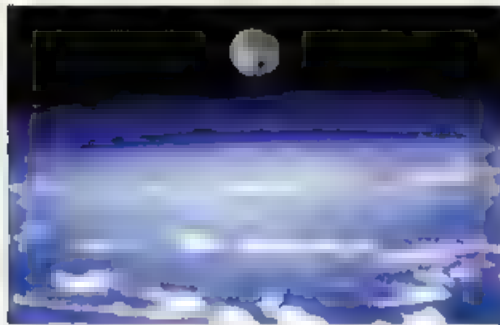



Fig (3 - 1): *The atmosphere of the earth*

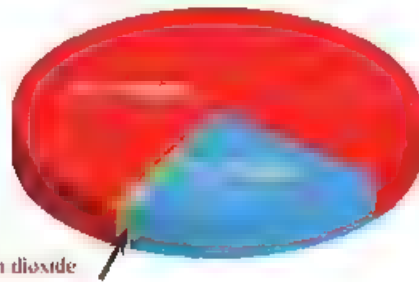



Fig (3 - 2): *Ratios of gases in the atmosphere*

You notice that nitrogen represents 78% of the total percentage of these gases. Oxygen represents 21% of the volume of the atmosphere (Oxygen occupies one fifth of the air volume). The remaining part of the atmosphere consists of water vapor, carbon dioxide and other gases such as argon, neon, helium and others.

The atmosphere protects the Earth by absorbing ultraviolet radiation coming from outer space. Also, it adjusts the temperature of the Earth's surface.

There are large quantities of solid objects in the atmosphere. These solid objects are dust particles, in addition to smoke and gases produced by factories, cars, trains and ships. Although solid objects are considered air pollutants, they help in the condensing of water vapor around and falling in the form of drops of rain or snow.

Fig (3 - 3): *Ships send out smoke and gases which pollute the atmosphere.*

Fig (3 – 4): *Plants are the main source of oxygen.*

Oxygen:

Oxygen is produced according to the availability of green plants. It is produced during photosynthesis Figure (3-4). Oxygen exists in the atmosphere in a gaseous state. It consists of two-atom-molecules that have the composition O_2 (the first letter of the word oxygen).

Oxygen atom | Oxygen atom | Oxygen molecule

Although oxygen is consumed in respiration and combustion, this shortage is always compensated through the sustainability of photosynthesis. Therefore, its proportion stays fixed in the air.

Activity

oxygen gas helps in burning

What do you need? A glass basin, a graduated cylinder, a candle, colored water.

What should you do?

- Fix a lighted candle inside a basin containing colored water.
- Cover the candle with the graduated cylinder.
- Determine the water level outside and inside the cylinder.

What do you notice?

- Share in discussion with your classmates: Which component of the air got reduced and replaced with water?
- Calculate the volume of water that rose inside the cylinder and record it

Fig (3–5) Oxygen gas helps in burning.

★ ***We can conclude that:*** **water rises into the cylinder. This occurrs as a result of air's loss of one of its components which is oxygen consumed by the candle during burning.**

we can conclude that   Air consist of oxygen gas which helps in burning.

Activity

Preparation of oxygen in the laboratory

What do you need? A glass flask, a stopper of two holes, a glass funnel with a faucet, a glass tube, a glass container, some glass cylinders, water, hydrogen peroxide (you can get it from pharmacies), manganese dioxide.

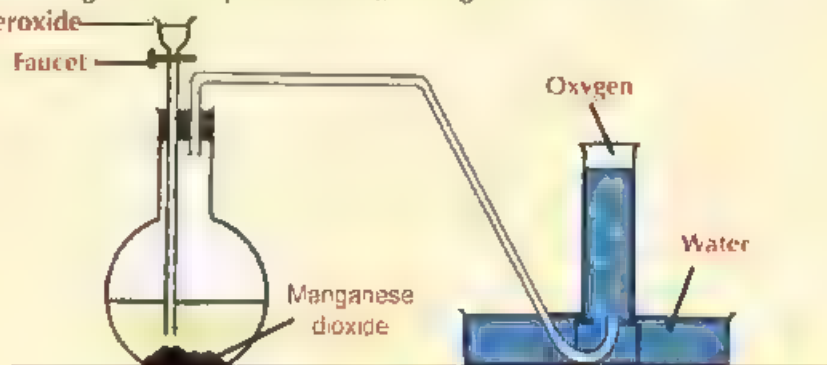



Fig (3-6) *Oxygen gas evolves as result of the dissociation of hydrogen peroxide under the effect of manganese dioxide.*

What should you do?

- Configure the apparatus shown in the figure (3-6) with the assistance of your teacher and your colleagues.
- Pour some manganese dioxide in the flask.
- Fill the funnel with hydrogen peroxide.
- Open the faucet to allow the leaking of some hydrogen peroxide on manganese dioxide.
- What do you notice?
- Close the faucet when the cylinder is filled with gas and then close the cylinder mouth and get the cylinder out of the container.
- Repeat the same steps to examine the properties of oxygen.

★ *We can conclude that:*

- Hydrogen peroxide dissociates in the presence of manganese dioxide (as a catalyst) into water and oxygen gas (manganese dioxide remains without a change in quantity and *structure* and so it is called a catalyst).

Scientists who benefited humanity

Oxygen was discovered in China in 800 BC. Then, it was re-discovered by Joseph Priestley in August 1774. Antoine Lavoisier gave it the name "oxygen" in 1778.

The properties of oxygen

There are a lot of compounds containing oxygen such as hydrogen peroxide (oxygenated water) and some salts.

Activity

Explore the properties of oxygen

◉ **What do you need?** Glass cylinders filled with oxygen, water, matches, Container filled with water

◉ **What should you do?**

Fig (3 - 7):

- Take a cylinder filled with oxygen and test its color and smell. What do you observe?
- Take a cylinder filled with oxygen and turn it upside down in a container filled with water. Does the water rise inside the beaker?
- Take a cylinder filled with oxygen, turn it over on the opening of another cylinder and insert a burning fragment in the upper cylinder and then in the lower cylinder.
- Insert a lighted magnesium ribbon in a cylinder filled with oxygen .

◉ **What do you observe?**

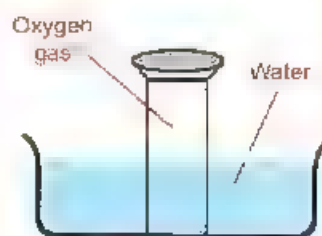



Fig (3-8) *Oxygen is a colorless gas.*

Fig (3 - 9) *Oxygen does not burn, but it helps in burning.*

The properties of oxygen can be identified as follows:

- Oxygen is a colorless, tasteless and odorless gas. figure (3-8).
- It scarcely dissolves in water.
- Oxygen does not burn, but it helps in burning. figure (9-3).
- Oxygen is heavier than air as it replaces the air.
- Oxygen combines with lighted magnesium to form magnesium oxide. (white matter)

★ *We can conclude that:* Oxygen is characterized by its ability to combine directly with most elements forming oxides. This is called oxidation If this combination is rapid and produces heat and light, it is named "burning", sometimes if it is slow and in the presence of moisture (water), it is named "oxidation". like formation of iron rust.

Activity

How is the iron rust formed?

- **What do you need?** Some nails or a piece of **cleansing dishes wire made of iron, water.**
- **What should you do?**
  - Wet the nails or the cleansing wire with water and leave it for several days in a humid atmosphere. What do you observe?
  - Compare between the iron after and before exposure to moisture.

Fig (3–10) *Rusty nails after exposure to moisture*

This explains the erosion of ironware such as the bridges' pillars. As time passes, if they are not isolated with paints, they cause damages.

Activity

- To verify this, do this activity with your colleagues and your teacher.
- **What do you need?** A digital scale, cleansing wire, tinfoil and stove.
- **What should you do?**
  - Make two balls of cleansing wire of the same mass by using the scale.
  - Take one of the balls with a pair of tongs and set it on the stove. When the inner part of the ball becomes red, put the ball on an aluminium plate until the flame is put out .
  - Using the scale, compare the mass of the two balls again. The one that got burned and that did not in terms of mass
  - Record your observations and discuss them with your colleagues and your teacher.

Fig (3–11) *A piece of burning cleansing wire.*

★ *We can conclude that:* the cleansing wire gets burned because the outer surface of the wire is large enough to react with oxygen in the air. So, combustion occurs quickly. The wire becomes heavier after burning because oxygen combines with iron forming iron oxide.

The importance and uses of oxygen:

Oxygen has a great importance to the human life and all living organisms.

1. The molecule of water consists of an oxygen atom combined with two at oms of hydrogen.
2. It is also important for respiration and food combustion processes inside living cells to produce energy necessary for vital processes.
3. Ozone is also composed of Three atoms of oxygen (O_3) which forms the ozone layer. It is a layer in the atmosphere that protects the Earth from harmful radiation that comes from the sun.
4. Oxygen gets compressed in iron cylinders and used in:
   - Mechanical ventilation for patients who suffer from breathing difficulties.
   - During surgeries.
   - During diving and climbing mountains. because oxygen becomes less when we go higher above the Earth's surface.
   - Oxygen is also used in cutting and welding metals when combined with acetylene gas to produce *"oxy-acetylene"* flame whose temperature reaches 3500°C sufficient to melt metals.

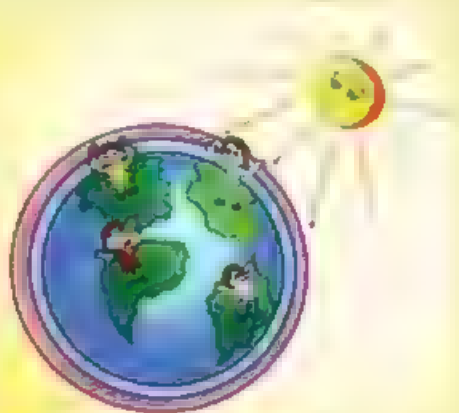



Figure (3-12) *The ozone layer protects the Earth.*

Figure (3-13) *Oxygen is used in welding.*

Exercises

1 Put (✓) in front of the true statements or (✗) in front of false statements.

a- Oxygen gas is produced according to the availability of green plants during photosynthesis process. ( )

b- Oxygen gas is prepared from hydrogen peroxide dissociates in the presence of carbon dioxide gas. ( )

c- The mass of materials decreases after combination with oxygen. ( )

d- Ozone gas is composed of 2 atoms and it has the symbol of O_3. ( )

e- The erosion of material which made of iron when exposed to moisture. ( )

f- Oxygen combines with a burning magnesium ribon forming white substance. ( )

2 Think and answer: If you know that oxygen does not burn but helps in burning. What happens to our lives if the oxygen percentage in the air is more than 21 %?

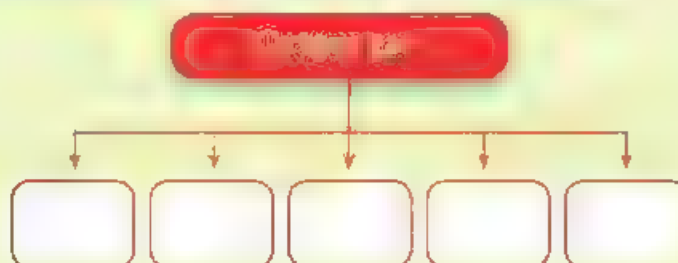
3 Justify:

a Although oxygen is consumed during respiration, its percentage remains stable in the atmosphere.

b Oxygen is collected by displacing the water downward in the jar during preparation at the laboratory.

c The atmosphere has a great importance for the continuity of life on the Earth.

4 Oxygen has a great importance for life on the Earth Water consists of oxygen combined with hydrogen. Give other examples of the importance of oxygen and its uses.

5 Write the properties of oxygen gas in the following chart :

Lesson Two (3 - 2)

Carbon Dioxide

Objectives

By the end of this lesson, you should be able to:

- Identify sources of carbon dioxide emission.
- Do experiments illustrating the properties of carbon dioxide.
- Determine the importance and the uses of carbon dioxide

Basic concepts

- Carbon dioxide

What are the benefits and harms of carbon dioxide?

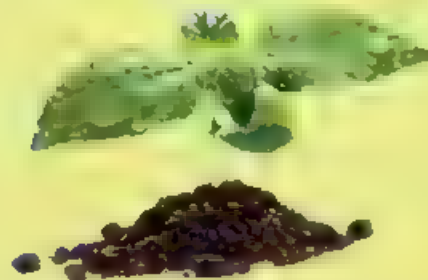
The presence of carbon dioxide in the atmosphere produces benefits for all living organisms. It is one of the bases of the photosynthesis process that green plants make. During this process, plants make the nutrients for living organisms. On the other hand, the increase of the percentage of carbon dioxide in the air leads to the suffocation of living organisms as well as global warming.

Green plants share in decreasing ratio of carbon dioxide in the atmosphere

Fig (3 - 14) *A model of a carbon dioxide molecule*

Carbon dioxide is a chemical compound found in the form of a gas in its natural state in the atmosphere by a slight percentage 0.03%.

Its molecule consists of one carbon atom combined with two oxygen atoms. It has the symbol CO_2 (figure 3-14).

Despite the fact that carbon dioxide is very important in the photosynthesis process of plants in order to build their bodies and make food for all other living organisms, the increase of its percentage causes severe harms to the Earth's climate and raises its temperature.

Fig (3 - 15) *Plants absorb carbon dioxide*

Carbon dioxide resources:

Carbon dioxide is emitted as a resulte of the respiration of living organisms and the combustion of organic materials such as :

- Wood
- Coal
- Oil
- Gasoline
- Tobacco (The material cigarettes is made of).

In recent years, it has been observed that the percentage of this gas in the atmosphere is rising. This is due to the burning of massive amounts of fuel in industrial plants and means of transportation engines.This is beside decreasing green areas and remova. of forests.

Fig (3–16) *Carbon dioxide is emitted from industrial plants*

Carbon Dioxide

Carbon dioxide results from respiration of living organisms and combustion of organic substances like candle. How can we detect the carbon dioxide inside these substances?

Activity

- **What do you need?** A jar or test tubes, clear limewater, a long juice straw)
- **What should you do?**
  - Pour some of limewater in the jar.
  - Blow in limewater for two minutes by using straw.
- **What do you observe?** ......

Fig (3-17) *Exhalation air contains CO_2*

Activity

- **What to you need?** bean or pea seeds, a jar or test tubes, clear limewater, a plastic tube, clay, cotton, water.
- **What should you do?**
  - Proved some seeds of plants such as beans or peas in a jar on cotton or sawdust wet.
  - Make a hole in the jar cover and insert a plastic tube through it. Fix it carefully using the clay as shown in figure (3 - 18).
  - Insert the other end of the tube in a jar of clear limewater and leave it for a several days . Observe the change in the limewater.
- **What do you observe?**

Fig (3-18) *during the respiration of germinated Seeds carbon dioxide is produced.*

Activity

◉ **What do you need?** A glass cylinder, a candle, clear limewater and glass cover

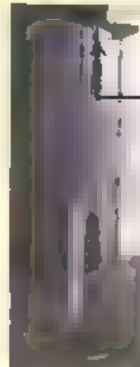



Fig (3-19) Carbon dioxide is produced during a candle burning

◉ **What should you do?**

- Fix a candle into a cylinder and light it .
- Cover the candle with a glass cover and observe it until the candle extinguishes.
- Remove the cover and pour a little of clear limewater inside the cylinder.

◉ **What do you observe?**

*** From the previous activities, we can canclude that:**

- Carbon dioxide is produced from the respiration of humans (the exhaled air) and respiration of plants . It is also produced from the combustion of organic substances. It turbids the clear limewater (calcium hydroxide) where white precipitate appears as a result of its reaction with carbon dioxide forming calcium carbonate, which don't dissolved in water.
- Turbidity of lime water is considered as detection of the presence of carbon dioxide.

Expermints show the proprties of carbon dioxide:

to identify the properties of carbon dioxide you need to prepare many cylinders of it

Activity

⦿ **What do you need?** Glass cylinders, glass flask with a stopper of two holes, a long funnel, diluted hydrochloric acid, calcium carbonate, a U-shaped glass tube.

⦿ **What should you do?**

- Configure the apparatus. shown in Figure (3 20).
- Pour a little acid on the calcium carbonate.
- Collect a set of cylinders filled with carbon dioxide by displacing the air upward.

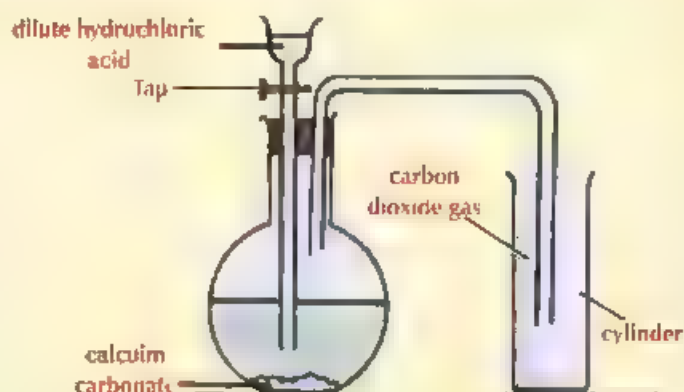



Fig (3 20) *Preparation of Carbon dioxide*

⦿ **Use the cylinders (filled with carbon dioxide) to do the following experiments so as to identify its properties**

1. Turn a cylinder filled with CO_2 upside down on a lighted candle. Record your observations and explain them (Figure 3-21) .
2. Through the activity of preparing carbon dioxide, you may have observed that it is collected by displacing the air upwards (Figure 3-20) What can you conclude? .
3. Insert a lighted match stick in a cylinder filled with CO_2. what do you observe ?
4. Insert a lighted magnesium ribbon in a cylinder filled with CO_2
   What do you observe? .
5. Squeeze half a lemon on a little of sodium bicarbonate in a glass or open a soft drink bottle. Observe the color of the evolving carbon dioxide and identify its smell. Record your observations and explain them

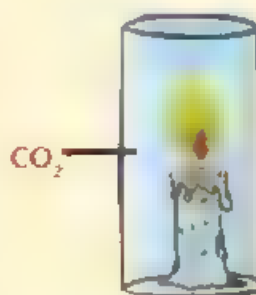



Fig (3 21) *CO_2 extinguishes the candle*

★ *Through the previous activities, we can determine the properties of carbon dioxide:*

- It is colorless and odorless.
- It is heavier than the air and so it is collected by displacing the air upward and replacing it.
- It easily dissolves in water, so it is not collected by displacing water as in preparing oxygen.
- It neither burns nor helps in combustion. So, it is used for extinguishing fires.
- The magnesium ribbon keeps burning and turns into a magnesium oxide (with white color) and the carbon (coal) deposits on the wall of the cylinder.

Man gets suffocated if he breathes carbon dioxide. It is called the silent killer because we can not see it, taste it or even smell it. Breathing in a closed space with no or bad ventilation leads to a gradual decrease in oxygen and an increase in carbon dioxide. Quickly, everyone gets suffocated and loses consciousness and then dies.

Importance and uses of carbon dioxide: it is used in:

- At very low tempratures, Carbon dioxide gas is converted into dry ice that we use in refrigeration.
- It is used in extinguishing some types of fires because it does not burn and does not help in burning.
- It is used to make soft drinks.
- It is used to make bread bubbled as yeast which produces carbon dioxide by fermentation when it is added. Carbon dioxide gets expanded due to the heat making bread porous and tasty.
- Carbon dioxide contributes in the photosynthesis process in green plants leading to the production of food as well as the production of oxygen.

Life application

Carbon dioxide is a key component in the manufacture of soda water. Drinking too much of it is unhealthy. Scientists call it the useless food because it does not contain any nutrients except sugar.

When you have soft drinks, you swallow amounts of carbon dioxide, and increase these quantities cause osteoporosis and may cause death because of the high ratio of carbon dioxide in the blood, which lead to not getting the oxygen needed for vital body process.

Fig (3 - 22) *Fire extinguisher generates, Carbon dioxiode used in extinguishing fires*

Exercises

1 What happens to our lives on the Earth if:

a. The percentage of carbon dioxide in the air increases.

b. The percentage of carbon dioxide in the air decreases.

2 Complete the following statements:

a. In photosynthesis process, the plant absorbs .... gas and produces .... gas while in respiration process, ... gas in consumed and .... gas is produced.

b. The ratio of carbon dioxide gas in atmospheric air is .... and has the symbole ....

c. Carbon dioxide gas is changed by .... and .... to liquid then pressure is relieved composing .... which use in refrigeration.

3 Give reasons for :

a. Carbon dioxide is used in extinguishing fires.

b. Yeast is added to the dough on making bread.

c. Clear limewater becomes turbid when carbon dioxide passes in it .

d. The environment suffers from increasing the ratio of carbon dioxide gas in recent years.

UNIT 1

Lesson Three (3 - 3)

Nitrogen

Objectives

By the end of this lesson, you should be able to:

- Identify the properties of nitrogen.
- Identify the importance of nitrogen.

Basic concepts

- Nitrogen
- Properties of nitrogen
- The importance of nitrogen

What do you know about nitrogen?

Nitrogen

It is a chemical element found in nature in the form of a gas and referred to by the symbol N_2 as the nitrogen molecule consists of two atoms of nitrogen.

Nitrogen is also called azote which means (lifeless) because it does not help in burning

It is a colorless, tasteless and odorless gas and hardly dissolves in water. It is a main component in all proteins

Daniel Rutherford, discoverer of nitrogen

The existence of nitrogen

Nitrogen represents 78% of the Earth's atmosphere and contributes in the composition of all living tissues in all living organisms. They need nitrogen to live as nitrogen composes the most important part in protein.

Nitrogen oxides are formed in the atomsphere during lightening (fig. 3-2 3) which reaches soil with rain water. Legumes such as clover, peas and soybeans produce proteins from atmospheric nitrogen by the help of a specific type of bacteria that live in their roots.

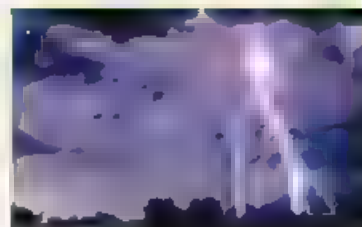



Fig (3- 23) *Oxygen reacts with nitrogen in the presence of lightning forming compounds known as nitrogen dioxides.*

More of Knowledge

The importance and uses of nitrogen :

- Nitrogen is recently used in filling car tires for the relative constancy of its volume at the change of temperature. (Figure 26)
- Small amounts of nitrogen are used to fill some types of lamps
- Nitrogen is used to make stainless steel.
- It takes part in the composing of gunpowder and ammonium nitrates included in the composition of soil fertilizert.
- It is commercially used in the manufacture of ammonia to produce fertilizers (Figure 3- 27).

Fig (3- 27) Nitrogen is used in filling tires

Fig (3- 28) Fertilizers

Nitrogen

Exercises

1 Write (✓) in front of the correct statements and (✗) in front of the false ones and correct the false one :

a. Legumes such as clover benefit from the nitrogen in the air. ( )

b. Nitrogen gas is also called azote which means life gas. ( )

c. Nitrogen gas is colorless, tasteless, odorless and dissolves in water easily ( )

2 **Choose the right answer :**

a. Nitrogen gas precentage is .... of the air.

1- 21%   2- 78%   3- 12%   4- 1%

b. Nitrogen is the most important part of ....

1- protenis   2- Corbohy drates.

3- fats.   4- water

c. From the properties of nitrogen is

1- it burns.

2- enter the structure of corbo- hydrates

3- enter the process of breathing.

4- Not help in burning

Unit (3) Test

1 Put (✔) in front of the correct statements and (✗) in front of the false ones and correct the false ones :-

a The nodular bacteria fix oxygen of air in the roots of leguminous plants such as beans and clover. ( )

b Oxygen gas occupies 78% of the atmospheric air componets. ( )

2 Justify:

The clear limewater is used in detection of carbon dioxide gas .

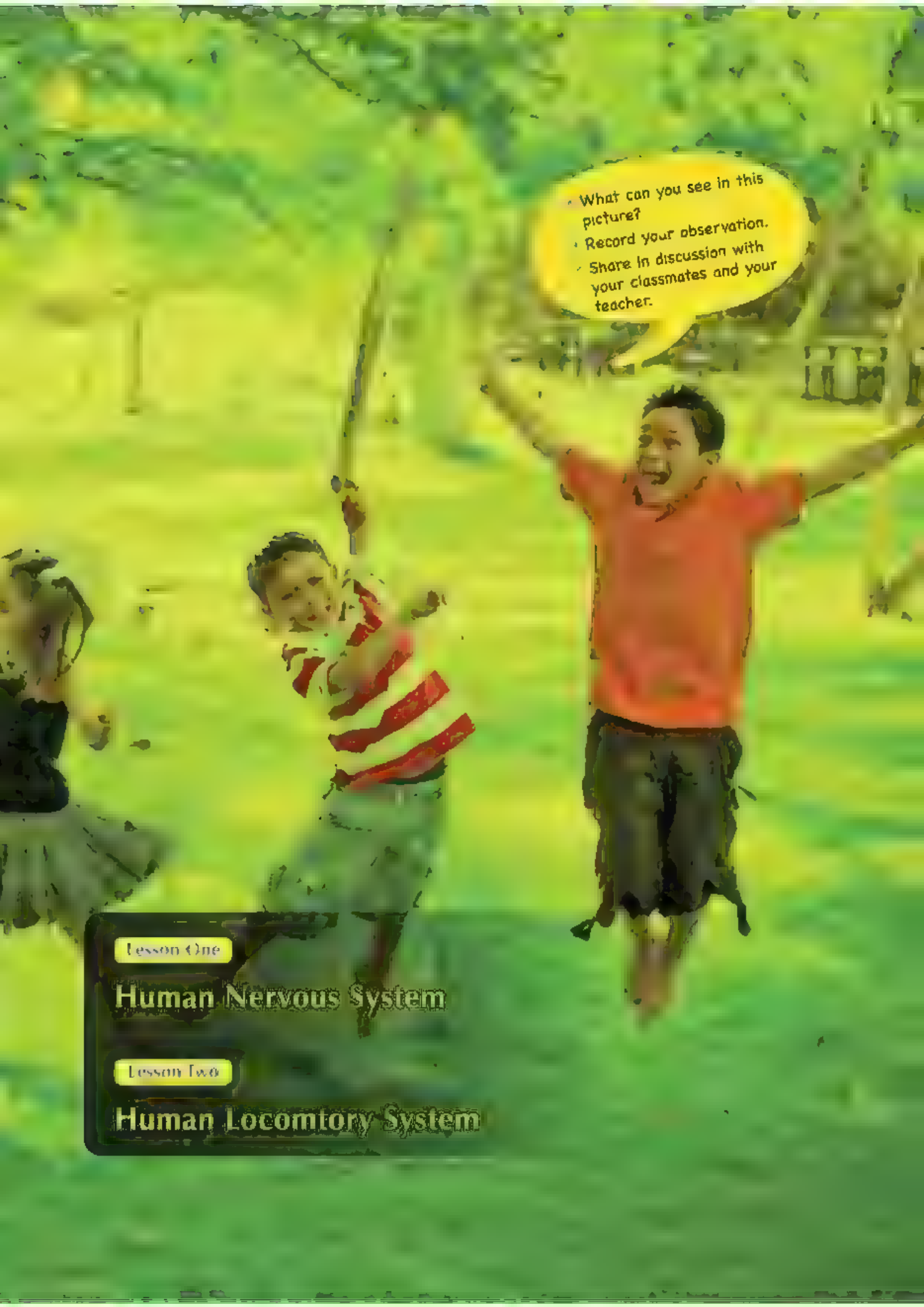
3 Explain how you get :

a Oxygen gas from hydrogen proxide .

b Carbon dioxide gas from wood .

4 Look at the opposite figure, then answer

1- Write what represents each label in figure:
- Substance (a): ....
- Liquid (b): ....

2 - Mention the uses of carbon dioxide gas:
1 - ....
2 - ....

Unit

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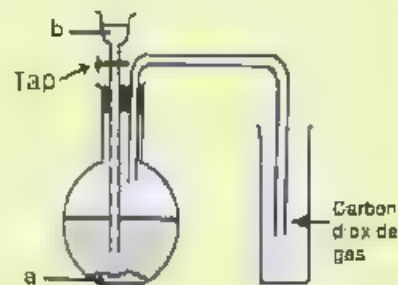

Structure and Function

Unit Objectives

By the end of this unit, you should be able to:

- Identify the structure and functions of the human nervous system.
- Explain the occurrence of reflex action.
- Identify the importance of the human nervous system and ways of maintaining it.
- Identify the structure of the human locomotory system.
- Explain the importance joints for movement.
- Identify some ways to maintain the locomotory system.

Unit introduction

This unit deals with the structure and function of nervous and locomotory systems in your body. It also deals with the ways of maintainance of both systems and their importance for your health.

What can you see in this picture?
Record your observation.
Share in discussion with your classmates and your teacher.
Lesson One
Human Nervous System
Lesson Two
Human Locomtory System

UNIT 4

Lesson One (4 - 1)

Human nervous System

Objectives

By the end of this lesson, you should be able to:

- Identify the structure and functions of the human nervous system.
- Explain the occurrence of reflex action.
- Identify the importance of the human nervous system and ways of maintaining it.

Basic concepts

- Brain
- Spinal cord
- Reflex action

Your nervous system is a communication and controlling device. It consists of the brain, the spinal cord and nerves. This important system receives information from your environment and from your body. Then, it interprets this information and makes the body respond to it.

Your nervous system lets you know if things are hot, cold, sweet, bitter, rough or smooth. It adjusts your movements, protects you from harm, makes you feel pain, makes you solve problems and learn music.

In addition, the nervous system adjusts the responses that require emotions. It makes you happy, sad, angry or calm.

It oversees the multiple functions performed by the human body such as moving, feeding, digestion, breathing, thinking and others. Then, it coordinates and regulates them.

Structure and functions of the human nervous system:

The nervous system consists of two major systems:

- The central nervous system.
- The peripheral nervous system.

Activity

- **What do you need?**

  A microscope, a slide of neuron

- **What should you do?**
  - Examine a slide of neuron by a microscope.
  - What do you observe?
  - The neuron consists of two main parts:
    - The cell body – the axon

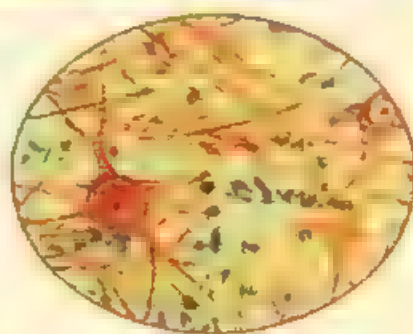



Fig (4–1): *The neuron under microscope*

1 Cell body:

- It contains a nucleus, cytoplasm and a plasma membrane.
- There are some branches extending from the neuron's body called dendrites connected to neighboring neurons composing the synapse.

2 The axon:

- It is a cylindrical axis covered with a fatty layer called myelin sheath. The axon ends with nerve endings (Axon terminals) connected to muscles or form a synapse with other neurons (See Figure 4 – 2).

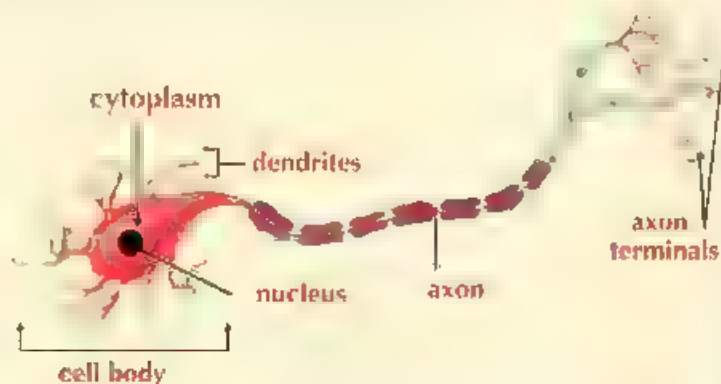
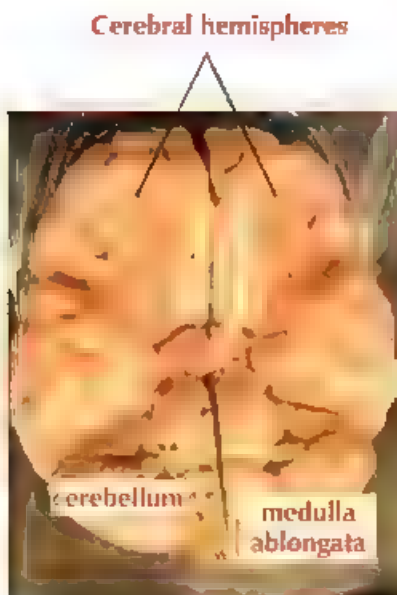



Fig (4–2): *The structure of a neuron*

First: The central nervous system

The system is composed of:

- The brain
- The spinal cord

Fig (4–3): *Structure of the brain*

1 The brain:

It is the main control center in your body. It directs and coordinates all the processes, ideas, behaviors and emotions.

The brain is located inside a bony box called the skull that works to protect it. It is a nerve block containing millions of nerve cells.

- Observe Fig (4-3) which illustrates the structure of the brain. It consists of:
  1. Cerebrum
  2. Cerebellum
  3. Medulla ablongata

Activity

Examine the sheep's brain

What do you need?

Fresh sheep's brain - dissecting tools (forceps - dissecting needle - scalpel).

What should you do?

- Examine the sheep's brain and identify its main parts.
- Make a longitudinal cutting through the hemispheres using the scalpel.
- Notice the difference in the color inside and outside the brain.

Record your observations:

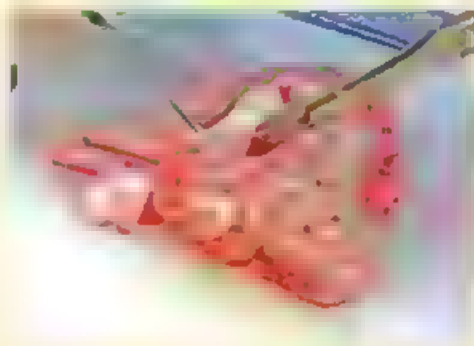



Fig (4–4): *A sheep's brain*

1 Cerebrum:

It is the largest part of the brain. It consists of two halves separated by a fissure and attached to each other through a nerve fibres which are responsible for cannection between them. The outer surface of the hemispheres is called cerebral cortex and it is gray. The hemispheres are characterized by having many convolutions and folds on their surface.

Fig (4 - 5): the brain's hemispheres.

The most important functions of the hemispheres are:

- Controlling the voluntary movements of the body such as walking, sitting and running in races.
- Receiving nerve impulses from sense organs (eyes, ears, nose, tongue and skin) and send appropriate responses to these impulses.
- Contain the centers of thinking and memory.

Do you know?

The adult human brain weighs about 1.5 kg. Some people believe that if the human brain gets bigger the intelligence will increase But this is not true, all adults have an equal brain sizes.

2 Cerebellum:

Cerebellum lies at the back area of the brain below two hemispheres.

Its most important functions are:

- Maintaining the balance of the body during movement.

3 The medulla oblongata:

The medulla oblongata is located in front of the cerebellum. It connects the brain with the spinal cord. Its function is regulating the involuntary processes of the body as:

- Regulating heart beats.
- Regulating the movement of the respiratory system parts during breathing.
- Regulating the movements and functions of the digestive system.

2 Spinal cord:

The spinal cord extends in a channel within a series of vertebrae in the backbone. It is cylindrical and the spinal nerves extend from it.

Fig (4-6). Structure of the spinal cord

Human nervous System

Activity

- **What do you need:** A microscope - ready made slide of the spinal cord.
- What should you do?
  - Examining the slide of the spinal cord by a microscope.
- Record your observations:
  - On examining a slide of the spinal cord, it is clear that the spinal cord consists of an internal substance that is the grey matter and it appears in the shape of letter H surrounded by the white matter.

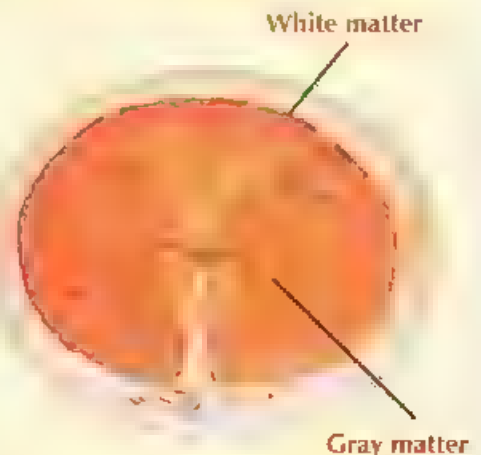



Fig (4-7): *Structure or spinal cord*

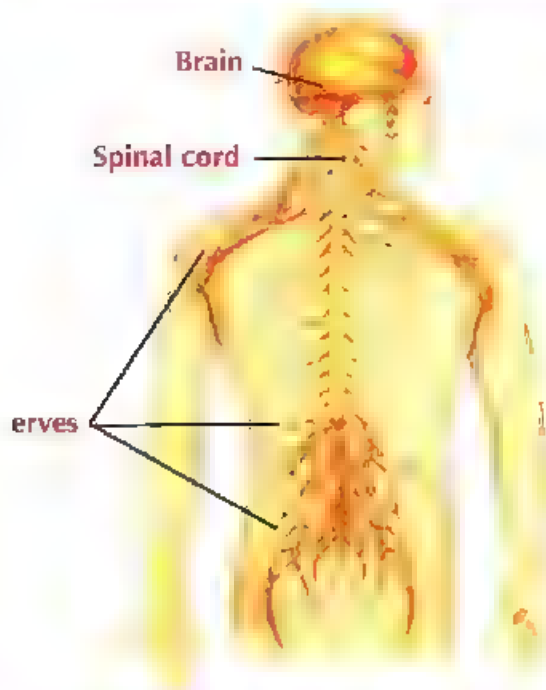



Fig (4-8): *The peripheral nervous system*

Functions of the spinal cord:

- It delivers nerve messages from body organs to brain and vice versa.
- It is responsible for the reflexes such as the withdrawal of the hand quickly on touching a hot surface.

Second: The peripheral nervous system

It is the nerves which emerge from the central nervous system; i.e. the brain and the spinal cord. The function of these nerves is to get sensory information and kinetic responses between the central nervous system and all parts of the body. There are 12 pairs of nerves which emerge from the brain known as cranial nerves and 31 pairs of nerves emerge from the spinal cord known as spinal nerves.

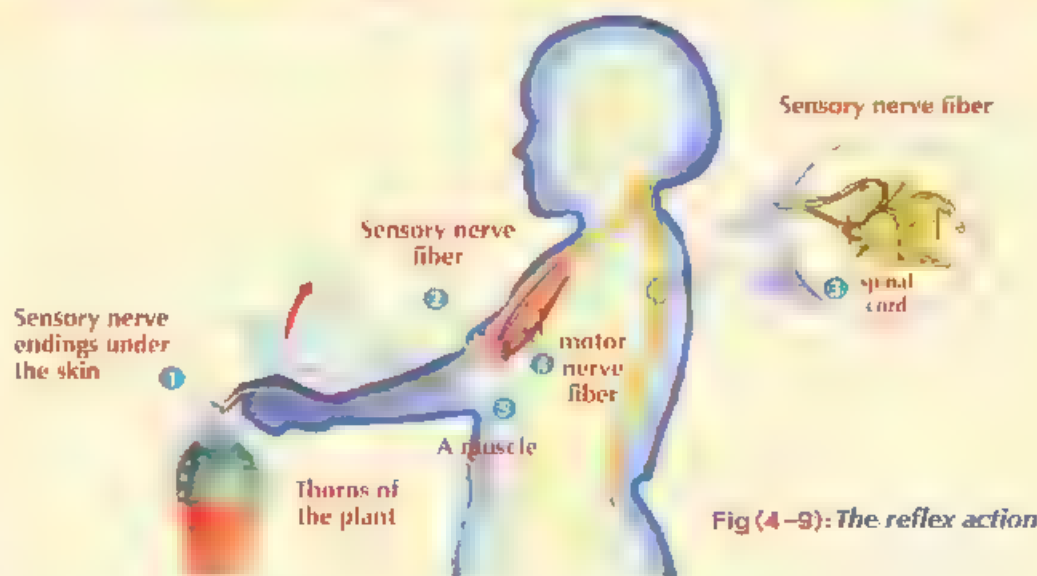
Reflex action

When the body is subjected to an external stimuli such as light, heat, and smell, it makes an involuntary response by The nervous system. It is called the reflex action. Why does the withdrawal of a hand occur quickly upon touching plants' thorns or a hot surface?

Activity

Explanation of the reflex action

◉ **In this activity, trace the stages of the reflex action:**

Fig (4 - 9): *The reflex action*

- The girl touched a plant with sharp thorns. She quickly picked up her hand. How did this occur?
- The severity of the thorns affects the nerve endings in the fingers resulting in nerve impulses.
- Nerve impulses are transmitted to the spinal cord through a sensory nerve fiber
- Nerve impulses are transmitted from the spinal cord through a motor nerve fiber to arm muscles (without the brain's intervention). Muscles contract and the arm withdraws away from the thorns.
- Other nerve impulses are transmitted from the spinal cord to the sensory centers in the brain which leads to the true sense of pain.

◉ **What do you conclude?**

◉ **Explain:** What happens when you suddenly touch a hot object?

Examples of reflex action

- Withdrawing the hand quickly when it touches a hot surface.
- Blinking when something gets close to the eye.
- What are the other examples of the reflex actions that you know?

▲ The hand touches a hot thing

▲ A thing gets close to the eye

The importance of the human nervous system and ways of maintaining it.

Now, it is clear that nevous system has a special importance because its main function is to carry nerve messages from one of the areas of the body to another area. It works on regulating and coordinating all the vital processes within the body. It also receives the external stimuli that surround the human being through the sensory organs and identifies and interprets them.

Ways of maintaining the human nervous system:

▲ Reducing the intake of coffee

- Reducing the intake of the stimulating substances such as coffee and others as they affect sleeping periods and heart beats and lead to nervous tension as well.
- Stay away from tranquilizers and stimulants.
- Not exhausting the sensory organs by sitting for long periods in front of the computer and television.

▲ Avoiding sitting for long periods in front of computer

- Giving the body a sufficient period of rest especially during sleeping
- Avoiding extreme exciting situations.
- Staying away from sources of pollution because they passively affect the nervous system as noisy places and smoke emitted from exhausts of cars, factories, ...etc.

▲ Staying away from sources of pollution.

- Doing physical exercises.
- Staying away from addiction because it passively affect on the nervous system as :
  - Retardation of memory and learning.
  - Nervous tension.
  - Sluggishness.
  - Loss time sensation.
  - Sleepless.

Exercises

1 Choose the correct answer:

a. The number of cranial nerves is .... pairs of nerves.
1. 31 2. 21 3. 12

b. The grey matter in the spinal cord appears in the shape of letter
1. H 2. F 3. A

c. The cerebellum is responsible for ....
1. thinking process 2. the body's balance 3. the reflex action

d. One of the components of nerve cell is the presence of ....
1. Blood vessels 2. cover of myelin 3. dendrites

e. .... controls reflex actions
1. Spinal cord 2. Cerebellum 3. cerebrum

2 Write the scientific term for each of the following statements:

a. Automatic response of the body to different stimuli.

b. Part of the nervous system responsible for reflex actions.

c. The basic structure unit of the nervous system.

d. Linked to the brain through the spinal cord and is responsible for involuntary actions.

e. Consists of a grey matter in the form of H letter surrounded by the white matter

3 Locate the following parts in the human body:

a. Cerebellum

b. Spinal cord

c. Hemispheres

d. Medulla oblangata

4 Mention the importance of:

a Medulla oblongata.

b Spinal cord

c Skull.

d Cerebellum.

e The two hemispheres.

5 What happens when:

a Sitting for long times in front of the computer.

b Your finger gets pricked by plant thorns.

c Continuous exposure to contaminated air from factories' smoke.

d Approaching something to the eye.

6 Give reasons for each of the following:

a Damage of the medulla oblangata causes death.

b The brain is located inside the skull and the spinal cord extends through the inside of the backbone.

c It is important not to take sleeping pills without the doctor's prescription.

d Withdrawal of the hand quickly when it suddenly touches a hot surface.

Lesson Two (4 - 2)

Human Locomotory System

Unit 4

Objectives

By the end of this lesson, you should be able to:

- Identify the components of human locomotory system.
- Explain the importance of joints to movement.
- Identify some ways to maintain the locomotory system.

Basic concepts

- Skeleton
- Joints

Read the lesson introduction and notice the new concepts. Record and discuss them with your colleagues.

Movement is the ability of the organism to change its position from a place to another. It is one of the characteristics that distinguish living organisms from non-living things.

Movement is one of the most prominent life aspects in the human life. It helps man to move from one place to another seeking benefit or away from harm. Movement occurs with participation and integration of special organs and systems such as the skeletal, muscular, and nervous systems that regulate and coordinate the required movement.

Movement is one of the most prominent life aspects in the human life

What are the components of human locomotory system?

The structure of human locomotory system:

Through the work of muscles and bones together, your body can move. Locomotory system consists of two major systems:

- The skeletal system
- The muscular system.

We will study the skeletal system only.

The skeletal system

- The human skeletal system consists of:
  - The axial skeleton
  - The appendicular skeleton

The axial skeleton

- The axial skeleton consists of the following parts:
  - The skull
  - Backbone
  - Rib cage
- Notice the parts in figure (4 - 10).

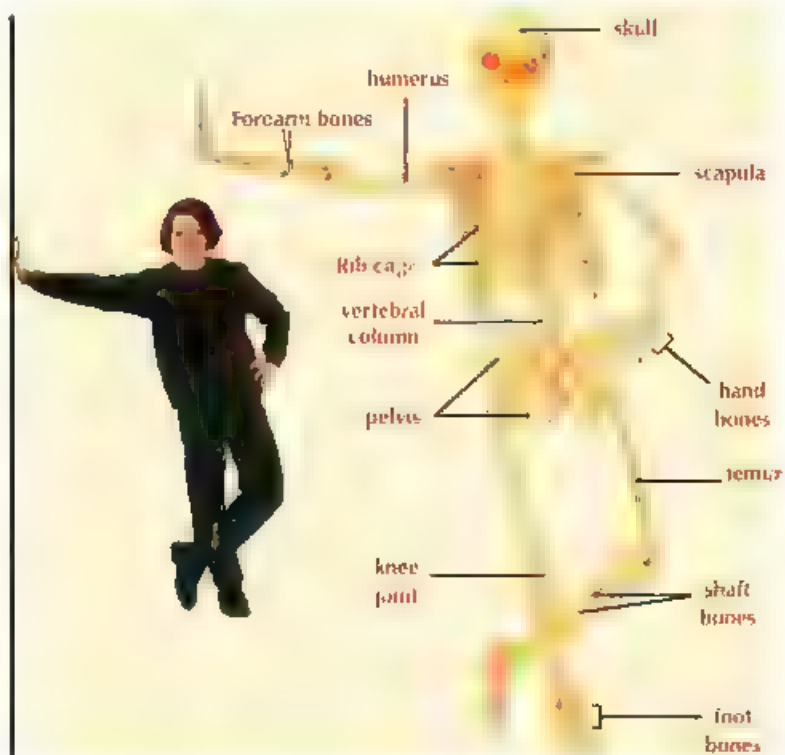



Fig (4 - 10): *The human skeleton.*

- **The skull:** is a bony box that contains cavities for the eyes, ears and nose. Its function is to protect the brain.
- **Backbone:** consists of 33 vertebrae with cartilages between them to prevent their friction during movement. The backbone function is to allow the body to bend in different directions and protect the spinal cord inside.
- **The rib cage:** consists of 12 pairs of ribs. The first ten pairs are connected anteriorly to the sternum (breastbone). The function of the rib cage is to protect the lungs and the heart, in addition to helping in the inhalation and exhalation processes.

Fig (4-11): *Bones of upper limbs.*

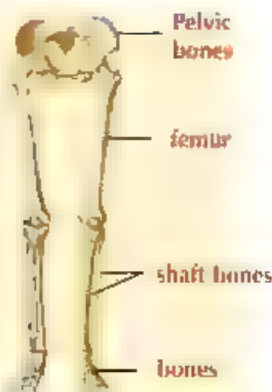



Fig (4-12): *Bones of lower limbs.*

Fig (4-13): *Slightly movable joint*

Appendicular skeleton:

- It consists of the bones of upper and lower limbs.

1. **Bones of the upper limbs:** are connected to the shoulder bones
   - humerus bone, forearm bones and hand bones.
   - The function of the two upper limbs is to allow eating, drinking, writing and holding things.
2. **Bones of the lower limbs** : are connected to the pelvic (hip) bones
   - Femur, shaft bones and foot bones.
   - The function of the lower limbs is to allow walking, running, standing, sitting and carrying the rest of the body.

Joints and their significance to movement:

- Can a human move if a l of his bones are fused together? (yes/no).
- Identify the locations where bones meet in the body by joints. All the joints of the body allow the movement between the bones.

- **Joints are three types:**

1. **Immovable joints:** such as the joints between the bones of the skull. They do not allow any movement.
2. **Slightly movable joints:** they allow movement in one direction only such as the knee and elbow joints.
3. **Freely movable joints:** they al ow movement in all directions such as the shoulder, th gh jo nts wrist in hand and ankle in foot.

Exercises

1 Write the scientific term for each of the following statements:

a Structure which consists of the skull, backbone and rib cage.

b Axis of the skeleton in the human body.

c The type of skeleton which includes the bones of upper and the lower limbs.

d Two bones meeting area.

2 Determine the type of the following joints:

a The knee joint

b Elbow joint

c Shoulder joint

3 What happens if:

Thigh joint has a limited movement.

4 Put (✔) in front of the correct statements and (✘) in the front of false one, and correct the false ones:

a The skeleton of lower limb consists of humerus bone, 2 forearm bones and bones of the hand. ( )

b Knee joint is a freely movable joint. ( )

c Shoulder joint is an immovable joint. ( )

d Joints link bones with muscles. ( )

Unit (4) Test

Unit (4) Test

1 Choose the correct answer:

a. Myelin sheath surrounds the ....
   1. nerve cell axon.
   2. cerebellum.
   3. spinal cord.

b. Reflex action takes place through the ....
   1. medulla oblongata.
   2. cerebral hemispheres.
   3. spinal cord.

c. The joint is the location of meeting of ....
   1. two bones.
   2. a muscle with a bone.
   3. two muscles.

d. Skulls joints are ....
   1. immovable.
   2. slightly movable.
   3. free movable.

2 Give the scientific term for each of the following statements:

a. The building unit of nervous system.

b. The organ which consists of an internal H-shaped grey matter surrounded with a white matter.

c. The autonomic body response towards different stimuli.

d. The skeleton which includes the upper and lower limbs.

3 Mention the location of the following parts in human body:

a. Medulla oblongata.
b. The cerebellum.
c. The H-shaped grey matter.
d. The spinal cord.

4 State the importance of each of the following:

a. Cerebellum.
b. Joints.
c. Cerebral hemispheres.
d. Rib cage.

5 Give reasons:

a. The rapid withdrawal of the hand on sudden touching thorns of a plant.

b. Damage of medulla oblongata may lead to death.

EKB links

Unit	Code	Link content	Lesson
One		Mass and weight	Mass and weight
Two		Heat	Heat conduction
		Heat and temperature	Heat conduction
Three		Discovering oxygen gas	Oxygen
		Importance of Carbon dioxide	Carbon dioxide
Four		The nervous system	Human nervous system
		Humman locomatory system	Human locomotory system
		Muscles : skelton and motion	Human locomotory system